

TOMATO DISEASES.

By C. C. Brittlebank, Plant Pathologist.

I.

The tomato industry in Victoria has, within the past ten to fifteen years, greatly increased, and it would be interesting to know the area under and returns from this crop, but no records have been kept.

As might be expected, when such a crop has been grown continuously in certain areas, and under forced conditions, diseases have become established, which claim a greater or less percentage of the yield. Thirty years ago (1886) paddocks of 30 or 40 acres of tomato plants were practically free from disease. Since then, however, several diseases have developed, and the object of this article is to describe briefly their appearance and the methods of control, so far as they are known at the present time.

The following diseases of tomato plants are found in Victoria:—

- Alternaria solani*, E. et M.—“Leaf mould,” or “Target spot.”
- Septoria lycopersici*, Speg.—“Leaf spot,” “Rust,” “Leaf blight.”
- Fusarium solani* (Mart), Sacc.—“Wilt,” “Sleepy disease.”
- Sclerotinia*—“Sclerotium disease.”
- Rhizoctonia solani*, Keuhn—“Root rot.”
- Phytophthora infestans*, De Bry—“Irish potato blight.”
- Bacillus solanacearum*, E. F. Smith—“Brown rot,” “Wilt.”

A New Tomato Disease—“Spotted Wilt.”

To the list above must be added a disease which has, within the last three years, appeared in tomato plants. The origin of this disease, as well as how and whence it was introduced, is, so far, unknown. Unfortunately, up to the present time no causal organism has been isolated, and consequently no method of control has been devised. However, it is the intention of the Science Branch of the Department of Agriculture to carry out experiments during the coming year, with the object of endeavouring to ascertain the cause of the disease and the method of controlling it.

A feature of this new tomato disease is that its most virulent period is during the prevalence of swarms of “Canary flies,” or “Jassids.” During the season just ended it was noted that as the Jassids decreased in numbers the disease waned, and the later plants were only slightly affected, while in many cases they have recovered to a great extent, but odd plants are still developing the disease. Numbers of early plants, which became diseased about January, have recovered also. As this disease is the most serious that the tomato grower has to contend against, and has been the cause of heavy losses in recent seasons, I shall deal with it first. It is well to have a common name for every tomato disease, and I propose that of “Spotted Wilt” for this latest one, from the spotting and subsequent wilting of the attacked plants.

Spotted Wilt was first observed during the 1915-16 season, when the injury was slight owing to the restricted area over which the disease had spread and to the comparatively small number of plants affected. In the following year the number of diseased plants had increased to an alarming extent. The present season (1918-19) has, to say the least, been disastrous, and fully 50 per cent. of suburban garden plants have

been destroyed. In the country districts the disease has made considerable progress, and diseased plants have been found in nearly all parts of Victoria.

Symptoms of the Disease.

The affected plants usually show the earliest evidence of attack on the young terminal leaves, from which it spreads rapidly to the lower leaves.

Affected leaves at first show a slight discoloration on the surface, and later numerous distinct blackish, or brownish, spots develop on their upper surfaces, sometimes, though not often, appearing also on the under side. If a leaf be held up to the light the spots will be seen distinctly as a pattern between the main veins. They may, however, be confluent when the whole leaf, with the exception of the main veins, is opaque.

A more critical examination disclosed the fact that the veins in some cases, as well as the mesophyll of the leaf, are also discoloured. Sometimes one-half of the veins are black or brown along some part of their length, and the other part clear or semi-transparent. Sections show that the vascular bundles are affected, but the injury to the leaf is almost always confined to the upper cells only.

The remarkable feature of the disease is the rapidity of its action. Plants, apparently healthy, develop within a few hours slight spotting of the leaves, and completely wilt from the tops downward in about 24 to 30 hours. Occasionally affected plants may last for several days, but in the majority of cases wilting and death take place rapidly.

Spotting is not confined to the leaves, but occurs on petioles and stem, appearing either as minute spots or thin brownish black lines or streaks, varying from 5 to 8 m.m. long by 1 to 5 m.m. broad.

On the stem and petioles the spotting is entirely superficial, and restricted to the outermost cortical and epidermal cells. The fruit is affected also, and the spots vary from a few to a number so great as to become confluent. The spots are of different size and shape, varying chiefly from circular to oblong, sunken or superficial, and in colour from brown to brownish black. In severe cases the tissue beneath the spots is injured and discoloured for a considerable depth into the flesh of the fruit. Diseased fruits, as a rule, fall, and those remaining on the plant do not ripen, or only redden in part, and are quite unfit for market. As a rule, however, affected plants fail to produce fruit, except in those cases where the plants have been affected late in the season. Very young fruits when affected turn brown, shrivel, and fall.

If the stem of the affected plants be split or cut through, no discoloration will be observed. The pith in parts is normal, and in others dry, shrunken, and cracked, forming numerous partitions, with spaces between, leaving sections of the stem more or less hollow. The disease does not affect the root system, which is usually of normal development, and in no way discoloured, and showing no signs of attack, either by fungi or nematodes. Careful microscopical examination has, so far, failed to reveal either fungi or bacteria within the plant tissue, and cultural methods have also failed to produce any organism.

Strong, vigorous, and luxuriant plants seem, on the whole, to be more subject to attack, but thrifty and unthrifty are liable to infection.

Dwarf varieties appear to be best able to resist attacks, the later planted bushes are not so seriously affected.

Experimental Work.

A number of experiments have been carried out in various ways with the sap expressed from diseased leaves; others with fragments of diseased leaves inserted in both stem and leaf. Portions of badly affected plants have been placed on the terminal shoots of healthy plants, and kept under bell jars at temperatures varying from 30 deg. to 40 deg. C., and in air having a heavy moisture content. A number of diseased terminal leaves and stems were crushed to pulp, water was added, and the combination filtered, and the filtrate mixed with soil in which young plants were growing; diseased leaves were crushed, and the pulp placed in the crowns of terminal shoots, some of which were pricked with a sterile needle, and sap from diseased leaves sprayed over young plants. All the plants, with the exception of two, were kept under bell jars, and under conditions which were most favorable for the development of either fungi or bacteria. No disease developed in any of the plants, and the checks both under and out of the bell jars remained clean.

The experiments and examination having failed to discover any causal organism, specimens of diseased plants were forwarded to Dr. Bull, Government Bacteriologist, and he also was unable to find any organism connected with the trouble. Thus the several investigations have thrown no light on the nature of the disease. Though the appearance of affected plants to the naked eye, the symptoms, rapid development of the discoloured areas, wilting and death of plants have all the characteristics of a bacterial disease rather than one of a physiological nature, fungi and bacteria are not present, or, at any rate, have not been isolated.

The Disease in Other Countries.

Looking up literature dealing with diseases affecting the tomato in various countries, I find that in the United States of America there is a disease which so closely resembles the one under notice that in all probability they are identical.

Professor Selby (Bulletin 73, Ohio Agricultural Exp. Station) gives the following description:—"An obscure disease of greenhouse tomatoes caused much anxiety at the station in the spring of 1895. Specimens of the same trouble have been received for examination; it also reappeared in 1896. This trouble shows itself as a general blighting of the plants attacked, and exhibits much of the same symptoms as winter blight, described in Bulletin 43 of the Experiment Station of Cornell University. In the present case the younger leaves showed earliest indications of the disease, and had a drooping appearance, with the leaflet turned inwards at the margins, and occasional dead areas. The attacked leaves soon die, and hang from the more or less drooping leaf stock. The thriftiest and most vigorous plants were apparently as commonly attacked as the others; the later plantings suffered most. The stems and leaf stalks of the affected plants showed blackened, elongated spots upon them. In the house where the trouble prevailed the green fruits were marked with dark-brown irregular spots of varying diameter. . . . For this blight no cause is at present assigned, and no organisms were found associated with it."

Later Investigations in the United States of America.

Hereunder are a few extracts from *Phytopathology*, vol. 6, No. 2, p. 162, 1916, "Investigation of a Troublesome Disease in Winter Tomatoes," by J. C. Howitt and R. E. Stone, giving results of examinations into the cause of the same mysterious disease:—

"In 1914, tomato plants were forwarded which showed a marked diseased condition of the leaves, stems, and fruit. Ten per cent. of the plants in the house were attacked. The disease appeared in the same house the following year. In August, 1915, the disease was observed in field tomatoes in two localities."

"Specimens showing symptoms of the disease were forwarded to Professor A. D. Selby for examination. These were examined by Mr. A. S. Orcut, who reported as follows:—'Upon examining the tomato material, and conferring with Professor Selby, it is our opinion that this is the same trouble which was reported from this section in 1896.'"

"The same disease apparently also occurs in the vicinity of Philadelphia. In January, 1915, diseased plants were forwarded to Messrs. Howitt and Stone by Professor C. R. Orton, Plant Pathologist, Pennsylvania State College. These, when carefully examined, were found to have spots and lesions on the stems, leaves and fruits characteristic of the disease as it occurs in Ontario."

SYMPTOMS OF THE DISEASE.

"The disease affects leaves, stems, and fruits. Affected leaves show distinct brown and blackened areas scattered between the layer veins. These are angular, or somewhat diamond-shaped, and are usually so numerous and close together that a distinct pattern is seen when affected leaves are held up to the light. An examination with a hand lens reveals the fact that discoloration is not confined to the mesophyll of the leaf, but extends to the secondary veins of the vascular bundles, is clearly evident. Affected leaves do not develop normally. They at first appear somewhat stunted, and, as the disease progresses, droop, and finally wither and die. In most cases observed the disease appeared to start on the upper younger leaves, and gradually work downward to the older leaves. On the stems of affected plants brown lesions are usually seen. These vary in size from 1 to 3 c.m. long, and almost half as wide."

ATTEMPTS TO DISCOVER THE CAUSAL ORGANISMS.

"When the diseased plants were received, a superficial examination disclosed the blackening and browning of the vascular bundles of the leaves. This symptom suggested that the trouble might be brown rot of tomato caused by *Bacillus solanacearum*, E.F.S. Microscopic examinations were made, but no fungus or bacteria were found associated with the lesions on leaves, stems, or fruit.

"Dilution plate cultures were made, but nothing was found to which the disease could be attributed. Fearing that in some way our technique might be at fault, specimens of diseased plants were submitted for examination to Dr. E. F. Smith, Bureau of Plant Industry, Washington, D.C.; Professor A. D. Selby, Agricultural Experiment Station, Wooster, Ohio; Dr. E. A. Bessey, Michigan Agricultural College; and Professor D. Jones, of the Bacteriological Department of Ontario Agricultural College.

"All these gentlemen kindly examined the material supplied, and reported the result. None of them found any organism capable of producing the disease."

EXPERIMENTAL WORK.

"Experiments were performed to determine if the origin of the disease was in the soil. These experiments, while by no means conclusive, suggests that the origin of the disease may be in the soil."

SUMMARY.

- "1. This disease is widespread, and may result in serious loss.
- "2. Little is known as to the cause of the disease.
- "3. Repeated microscopical examinations and plate culture tests with various media have failed to disclose a causal organism.
- "4. Inoculation experiments have given negative results.
- "5. The position and nature of the leaves, and the fact that the disease fails to develop further in affected fruits when these are removed from the plants and placed in a moist chamber, indicates that this is a so-called physiological trouble.
- "6. The experiments with hydrocyanic acid gas indicate that fumigation does not cause the disease.
- "7. Experiments on sterilized soil seem to indicate that the origin of the disease is in some way connected with the soil, but as no causal organism has been formed it would seem that the disease might be due to some chemical or physical deficiency in the soil, which is apparently overcome by sterilization.
- "8. This account of the disease is published with the object of again calling attention of plant pathologists to it, with the hope of stimulating discussion and research regarding its cause and control."

This disease in tomato plants which has been under investigation by American plant pathologists is, I think, identical with the one which I have named Spotted Wilt. The appearance, symptoms, and failure to obtain any causal organism agree. Further, the disease differs from all known tomato troubles caused by fungi, bacteria, or nematodes. The disease is a serious one, and threatens the tomato industry, probably to a far greater extent than all the other diseases which have found a place here.

PRACTICALLY the whole of the paper used in Australia at present is imported, and a considerable number of investigations and inquiries have been made with a view to finding some suitable raw material in Australia from which paper can be manufactured in large quantities. The importance of this matter, and the possibilities of establishing the industry of Australia, can be gauged by the fact that the annual imports of paper into Australia are valued at no less than £1,800,000.

The whole question has received the attention of the Commonwealth Institute of Science and Industry, which has issued a Bulletin giving the results of some investigations of much interest and importance which have been carried out by the Institute.

Copies of the Bulletin may be obtained free on application to the Secretary, Institute of Science and Industry, 314 Albert-street, East Melbourne.

STANDARD TEST COWS.

Report for Quarter ending 31st December, 1918.

Eighty-one cows completed the term, of which number 74 qualified for Certificates.

The following are the individual records:—

W. K. ATKINSON, Swan Hill. (Shorthorn.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Duchess 43rd	Not yet allotted	18.1.18	273	lbs. 10	lbs. 4,862	4.20	lbs. 204.43	lbs. 200	lbs. 233

Mrs. A. BLACK, Noorat. (Jersey).

Completed since last report, 4. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Marguerite	3576	20.3.18	273	lbs. 4	lbs. 6,137	4.44	lbs. 272.66	lbs. 250	lbs. 311

DEPARTMENT OF AGRICULTURE, Wyuna. (Jersey and Friesian).

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Jersey—				lbs.	lbs.		lbs.	lbs.	lbs.
Baroness of Wyuna ..	4881	10.1.18	273	21	6,812	5.68	386.97	250	441
Friesian—									
Dominion Milkmaid ..	714 N.Z.	13.1.18	273	32	10,451	3.73	390.10	250	445

C. G. KNIGHT, Cobram. (Jersey.)

Completed since last report, 6. Certificated, 6.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Pastime of Tarnpirr ..	5164	1.1.18	273	lbs. 204	lbs. 5,025	5.76	lbs. 289.39	lbs. 175	lbs. 330
Princess of Tarnpirr ..	2986	1.1.18	273	17	7,333	5.01	367.72	250	419½
Christmas	4206	20.2.18	273	18	5,824	6.42	374.16	250	426½
Miss Fox of Tarnpirr ..	5162	17.3.18	273	26	7,244	5.82	421.57	175	480½
Postcard of Tarnpirr ..	5167	26.3.18	273	14	4,955	6.81	337.57	175	384½
Trixie of Tarnpirr ..	5173	26.3.18	273	15	5,476	6.48	355.45	175	405½

DEPARTMENT OF AGRICULTURE, Werribee. (Red Poll.)

Completed since last report, 12. Certificated, 9.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Birdseye	Not yet allotted	26.12.17	273	lbs. 15	lbs. 7,202	5.00	lbs. 360.31	lbs. 250	lbs. 410 $\frac{1}{4}$
Crimea	"	26.12.17	273	17 $\frac{1}{2}$	5,917	3.98	235.36	175	268
Persica	"	26.12.17	273	24	7,519	4.74	356.20	250	406
Scotia	"	27.12.17	273	21	7,036	4.32	303.93	175	346 $\frac{1}{2}$
La Belle France ..	"	29.12.17	273	15	8,095	4.35	352.05	250	401 $\frac{1}{2}$
La Plata	"	30.12.17	273	13 $\frac{1}{2}$	6,373	3.94	251.57	175	286 $\frac{1}{2}$
Briar	"	8.1.18	273	17	6,783	4.37	296.55	250	338
Empire	"	31.1.18	273	14 $\frac{1}{2}$	7,959	4.69	322.50	250	321 $\frac{1}{2}$
Santa Clara	"	8.2.18	273	10 $\frac{1}{2}$	7,227	4.59	331.89	250	378 $\frac{1}{2}$

G. M. GANGE, Junr., Mininera. (Ayrshire.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Gardinia of Seafield ..	Not yet allotted	10.2.18	273	lbs. 12	lbs. 6,784	4.68	lbs. 317.46	lbs. 250	lbs. 362

GEELONG HARBOR TRUST, Marshalltown. (Ayrshire.)

Completed since last report, 3. Certificated, 3.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Sylvia of Sparrovale ..	2515	3.1.18	273	lbs. 5	lbs. 6,788	4.17	lbs. 283.10	lbs. 250	lbs. 322 $\frac{1}{2}$
Frolic of Sparrovale ..	2874	21.1.18	273	15 $\frac{1}{2}$	7,429	4.42	328.02	250	374
Flower of Sparrovale ..	3893	15.3.18	273	21 $\frac{1}{2}$	6,680	4.66	311.22	250	354 $\frac{1}{2}$

T. HARVEY, Boisdale. (Jersey.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Bluebell of Jerseyholm ..	Not yet allotted	*27.3.18	273	lbs. 9 $\frac{1}{2}$	lbs. 3,885	6.27	lbs. 243.72	lbs. 175	lbs. 277 $\frac{1}{2}$

* Calved 6 weeks prematurely.

S. CULLIS HILL, Lower Plenty, Heidelberg. (Jersey.)

Completed since last report, 2. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Carnation	314 C.S.H.B.	23.2.18	273	lbs. 12½	lbs. 6,039	4·62	lbs. 278·87	lbs. 250	lbs. 318

A. W. JONES, "St. Albans," Geelong. (Jersey and Friesian.)

Completed since last report, 3. Certificated, 3.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Jersey—				lbs.	lbs.		lbs.	lbs.	lbs.
Belle of Colac	4024	7.1.18	273	19	8,331	4·19	349·48	250	398
Silver Queen II. of Colac	4032	11.1.18	273	28½	7,573	6·42	486·44	250	554½
Friesian—									
Bolobek Rose	Not yet allotted	18.2.18	273	25	6,857	4·14	284·00	175	323½

C. G. LYON, Heidelberg. (Jersey.)

Completed since last report, 11. Certificated, 11.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
				lbs.	lbs.		lbs.	lbs.	lbs.
Melford Mascotte	5215	28.12.17	273	17	5,669	5·47	309·91	175	353½
Symphony	4281	19.1.18	273	18	5,622	6·03	339·21	250	387
Audrey Lassie	825	21.1.18	273	14½	6,919	4·71	325·55	250	371
Ettie V. of Banyule	5204	27.1.18	273	14½	4,780	5·14	245·89	175	280½
Statuette	4251	31.1.18	273	22½	7,312	5·75	420·36	250	479½
Molly V. of Banyule	5216	6.2.18	273	6½	6,181	5·61	346·88	200	395½
Silvermine XIV. of Banyule	5220	12.3.18	273	20	7,798	4·91	383·34	200	437
Molly II.	614	13.3.18	273	17	6,527	5·01	327·07	250	373
Lassie II.	1136	16.3.18	273	19½	7,309	4·85	354·87	250	404½
Silvermine XVI. of Banyule	5222	20.3.18	273	15	4,901	5·67	278·05	175	317
Noble Jessie	2343	26.3.18	273	18	6,832	5·29	361·48	250	412

J. MACKENZIE, Glenroy. (Jersey.)

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Princess of Kudala	Not yet allotted	2.1.18	273	lbs. 7½	lbs. 3,404	5·34	lbs. 181·64	lbs. 175	lbs. 207
Lady Perfection	"	4.1.18	273	11	3,413	6·50	221·78	200	252½

MEIER BROS., Box Hill. (Jersey.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Rosetta of Box Hill ..	5231	7.2.18	273	lbs. 13	lbs. 3,668	5.29	lbs. 194.11	lbs. 175	lbs. 221½

T. MESLEY, Dalyston. (Jersey.)

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Tilly Lantry, late Lily ..	5257	10.1.18	240	lbs. 4	lbs. 4,911	5.26	lbs. 258.42	lbs. 250	lbs. 294½
Shadow ..	Not yet allotted	19.2.18	273	10½	4,520	5.79	261.58	175	298½

MUHLEBACH BROS., Batesford. (Ayrshire.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Lily of Retreat ..	2961	17.1.18	237	lbs. 4	lbs. 5,412	4.69	lbs. 253.11	lbs. 200	lbs. 288½

MRS. L. ORCHARD, Grahamvale. (Jersey.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Pansy of Grahamvale ..	5330	8.1.18	273	lbs. 9	lbs. 4,334	5.25	lbs. 227	lbs. 175	lbs. 259½

W. PARBURY, Warburton. (Jersey.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Fuchsia IX. of Melrose ..	381 C.S.J.H.B.	5.2.18	273	lbs. 18	lbs. 5,701	5.75	lbs. 327.76	lbs. 250	lbs. 373½

O. J. SYME, Macedon. (Friesian.)

Completed since last report, 3. Certified, 3.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Duchess of Friesland Park	Not yet allotted	5.1.18	273	lbs. 22	lbs. 8,040	3.63	lbs. 291.53	250	lbs. 332½
Domino's Hergeveld Belle	"	13.1.18	273	21	8,151	3.81	310.83	200	354½
Bolobek Jean	"	18.2.18	273	19½	6,414	3.89	249.29	175	285

W. WOODMASON, Malvern. (Jersey.)

Completed since last report, 13. Certified, 13.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Lassie Fowler V. of Melrose	5550	2.1.18	273	lbs. 13	lbs. 4,670	5.99	lbs. 279.92	250	319
Flower IX. of Melrose	5535	11.1.18	273	20½	5,335	6.27	334.69	200	381½
Quality VI. of Melrose	3674	17.1.18	273	30½	9,401	4.99	469.31	250	535
Fuchsia X. of Melrose	4516	19.1.18	273	17½	8,209	4.63	379.98	250	433½
Handsome Girl VII. of Melrose	5541	21.1.18	273	18	6,339	6.78	430.80	250	491
Mystery XII. of Melrose	3667	22.1.18	273	20½	6,871	5.57	383.09	250	436½
Pearl V. of Melrose	5557	1.2.18	273	13½	4,963	5.83	289.24	200	330
Jessie's Progress	3657	9.2.18	273	17½	5,880	6.07	357.11	250	407
Lily VI. of Melrose	5552	11.2.18	*265	14½	5,110	7.05	360.01	200	410
Daisy V. of Melrose	3637	3.3.18	273	13½	5,774	5.23	302.16	250	344½
Mates V. of Melrose	4524	6.3.18	*240	22½	6,479	5.37	348.16	250	397
Flower VI. of Melrose	3641	8.3.18	273	27	7,933	5.55	439.23	250	500½
Jessie XVI. of Melrose	5547	21.3.18	225	18½	5,256	6.26	328.86	200	375

* Sold before completion of term.

RYAN AND HOWLEY, Axedale. (Ayrshire.)

Completed since last report, 1. Certified, 1.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Lottie of Golden Vein	3079	20.2.18	273	lbs. 18	lbs. 7,921	4.40	lbs. 348.91	250	lbs. 397½

A. H. S. SCHIER, Caldermeade. (Ayrshire.)

Completed since last report, 2. Certified, 2.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Myrtle II. of Pine Grove	4637	16.3.18	273	lbs. 22½	lbs. 6,546	4.30	lbs. 281.71	175	lbs. 321½
Countess II. of Pine Grove	4627	27.3.18	273	6½	3,873	5.03	194.85	175	222½

J. D. READ, Springhurst. (Jersey.)

Completed since last report, 8. Certificated, 8.

Name of Cow.	Herd Book No.	Date of Calving.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
Stock of Springhurst	5406	5.3.18	*239	lbs. 11	lbs. 3,983	5.34	lbs. 212.51	175	242½
Nightshade of Springhurst	3707	7.3.18	273	20	7,955	5.34	425.37	250	485
Brighton Princess of Springhurst	5391	17.3.18	273	13½	5,325	5.51	293.18	175	334½
Pimpernel of Springhurst	5401	19.3.18	273	12½	5,653	5.14	290.79	175	331½
Anemone of Springhurst	5386	21.3.18	273	13	5,865	5.46	320.45	175	365½
Princess Royal of Springhurst	5403	21.3.18	273	13	5,086	5.79	294.36	175	335½
Columbine of Springhurst	5392	26.3.18	273	15½	5,106	6.37	325.51	175	371
Banksia of Springhurst	5387	27.3.18	273	14½	6,607	6.14	405.67	200	462½

* Dried off with mammitis.

In the field of agriculture we have agencies and instrumentalities, fortunately, such as no other Government in the world can show. The Department of Agriculture is undoubtedly the greatest practical and scientific agricultural organization in the world. Its total annual budget of \$46,000,000 has been increased during the last four years more than 72 per cent. It has a staff of 18,000, including a large number of highly trained experts, and alongside of it stand the unique land-grant colleges, which are without example elsewhere, and the 69 State and Federal experiment stations. These colleges and experiment stations have a total endowment of plant and equipment of \$172,000,000 and an income of more than \$35,000,000, with 10,271 teachers, a resident student body of 125,000, and a vast additional number receiving instruction at their homes. County agents, joint officers of the Department of Agriculture and of the colleges, are everywhere co-operating with the farmers and assisting them. The number of extension workers under the Smith-Lever Act and under the recent emergency legislation has grown to 5,500 men and women working regularly in the various communities, and taking to the farmer the latest scientific and practical information. Alongside these great public agencies stand the very effective voluntary organizations among the farmers themselves, which are more and more learning the best methods of co-operation and the best methods of putting to practical use the assistance derived from governmental sources. The banking legislation of the last two or three years has given the farmers access to the great lendable capital of the country, and it has become the duty both of the men in charge of the Federal reserve banking system and of the farm-loan banking system to see to it that the farmers obtain the credit, both short and long, to which they are entitled not only, but which it is imperatively necessary should be extended to them, if the present tasks of the country are to be adequately performed. Both by direct purchase of nitrates and by the establishment of plants to produce nitrates, the Government is doing its utmost to assist in the problem of fertilization. The Department of Agriculture and other agencies are actively assisting the farmers to locate, safeguard, and secure at cost an adequate supply of sound seed.—*From President Wilson's Message to the Farmers' Conference at Urbana, Ill., 31st January, 1918.*

THE AUSTRALIAN FLORA FROM AN ORNAMENTAL ASPECT.

(Continued from page 187.)

Edward E. Pescott, F.L.S., F.R.H.S., Government Pomologist.

Gum Trees—continued.

Now that the use of eucalyptus foliage, or "gum leaves" as they are familiarly called, has become so universal for in-door decoration purposes, it is well to mention certain species, of which *cosmophylla* is one, which have handsome and decorative foliage. As is well known, eucalypts have, at different stages, two types of foliage. The foliage of the young plant in the seedling and "sucker" stage is known as juvenile foliage, and it is usually far more decorative in appearance than the mature or adult foliage. Very often, the juvenile foliage is broad and roundish, while the adult foliage is narrow and long. The broad, round leaves are the more sought after, particularly when they bear that mealy vestiture which gives them a silvery-grey appearance. Some eucalypts retain this silvery-grey or glaucous appearance even on the adult foliage. Such a species is *Eucalyptus tetragona*, the mealy gum, which is really a tall shrub, growing to slightly over 20 feet. So far back as 1827, this species was grown in England as a conservatory pot plant, under the name of *Eudesmia tetragona*. The broad leaves, and the stems, too, are very mealy in appearance, due to the whitish waxy bloom with which they are covered. The white flowers, too, are very beautiful. It is also known as *Eucalytus pleurocarpa*.

Eucalyptus cordata, the white peppermint, as well as *Eucalyptus pulverulenta*, the silver leaf stringy bark, also possesses this mealiness of foliage and stems, and the roundish leaves, which are usually in pairs, opposite to each other, are very decorative. Such a type of foliage is in appearance like the juvenile foliage of some species. The following species, *Gunnii*, the Cider gum; *populifolia*, the poplar leaf gum; *gamophylla*, the joined leaf gum; *polyanthemos*, the red box; and others, all have this type of foliage. The apple gum, *Eucalyptus Stuartiana*, too, has it in its juvenile stage of growth. The young foliage of the blue gum, *Eucalyptus globulus*, is also very decorative on account of this characteristic, and for the first three or four years the young tree is very decorative in any shrubbery. Later on the tree is very straggly, and quite unornamental. On account of the beauty of its juvenile foliage, this species is largely grown as a conservatory pot plant in the northern hemisphere.

Eucalyptus alpina, the Grampians gum, a species found only in the Grampians, in Victoria, has a fine shrubby habit, with rich, glossy, green leaves, and good white flowers. This has been successfully grown as a fine lawn specimen.

For decorative trees in large gardens, *Eucalyptus maculata*, the spotted gum, may take pride of place. It is one of our most shapely gums, with very good glossy foliage, having a wonderfully blotched and mottled bark. About the end of the year, the old bark flakes off in irregular patches, disclosing colourations of brown, cream, and pure white. This characteristic of blotched and mottled bark is also noticeable in the valuable timber tree, the river red gum, *Eucalyptus rostrata*. This is one of the most ornamental of gums, and is to be found in almost all parts of the Commonwealth.

Many of the gums have clear white or bluish-white bark, which makes them stand out in a very striking manner among dark foliage. Such is the lemon-scented gum, *Eucalyptus citriodora*, whose leaves, when bruised, emit a delicious lemon-citron odour. It is a poor specimen tree, but, in association with dark and closer-foliaged trees, it is very handsome.

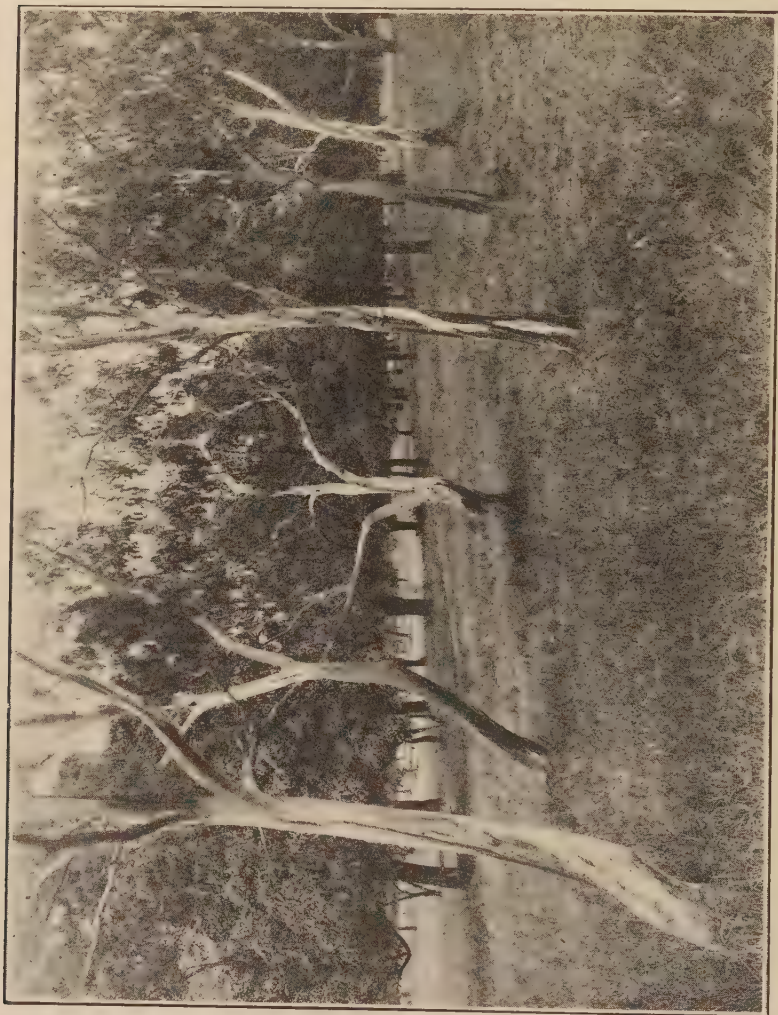


Mahogany Gum—*Eucalyptus botryoides*.

Similarly, *Eucalyptus saligna*, the willow leaf gum, a more shapely tree, stands out well in the tree garden. *Eucalyptus cinerea*, the silver stringy bark, too, with its whitish-brown trunk, and glaucous decorative foliage, is a fine shapely tree, and one of the most magnificent of gums. *Eucalyptus viminalis*, the Manna gum, and *Eucalyptus rubida*, the candle bark gum, also appear as finely white-barked gums.

In some of the glens in the Mount Lofty Range, in South Australia, and at Healesville and Gippsland, in Victoria, groups of these "White" gums create a magnificent picture in the forest scenery.

Among the dwarf gums possessing the decorative bark, the Snow gum, *Eucalyptus coriacea* (*pauciflora*), is, perhaps, the finest. A native of the snow-topped mountains, yet it grows well in the lower and warmer situations in the State. The group illustrated shows its dwarf character, for the trees are over thirty years old.



Snow Gums—*Eucalyptus coriacea*.

One of the fastest-growing of gums is the Mahogany Gum, of Gippsland, *Eucalyptus botryoides*. It is a decorative tree, and has been known to grow at the rate of a foot a month for twelve months in a very happy situation. The tree illustrated, which looks like a forest veteran, is about twenty-eight years old. *Eucalyptus radiata*, the river white gum, is another decorative type, having a fine drooping habit. The

Karri, *Eucalyptus diversicolor*, and the Jarrah, *Eucalyptus marginata*, thrive well in cultivation, as also does that fine tree, the Brisbane Stringybark, *Eucalyptus siderophloia*. Another very ornamental tree is the Bloodwood, *Eucalyptus corymbosa*. Indeed, it may be said that any of the eucalypts will succeed as a cultivated plant.

The gum tree most popularly grown, especially for shade, is *Eucalyptus corynocalyx* (*cladocalyx*), the Sugar Gum. It is a quick grower, and apt to grow tall, leaving the lower growths unfurnished. In Horsham, Victoria, there are magnificent avenues of sugar gums



Blossom of Brisbane Stringybark—*Eucalyptus siderophloia*.

planted as street trees. The sugar gum has very brittle wood, and the long sprawling limbs often snap off under stress of a wind storm. It is also subject to the boring larvæ of certain beetles and moths.

Eucalypts may all be trimmed or pruned into shape. Indeed, many of the quick-growing ones, like the sugar gum, may be cut hard back to the trunk, leaving only the bare stem standing. The pruning should be done in early spring, so that the subsequent tender growths will not be injured or burned by frost.

(To be continued.)

AN ECONOMIC PLANT.

THE JERUSALEM ARTICHOKE.

By J. W. Audas, F.L.S., F.R.M.S., Assistant, National Herbarium, Melbourne.

The Jerusalem artichoke (*Helianthus tuberosus*), a plant of the natural order Compositæ, is a native of North America. It is a hardy perennial herb with rod-like stems 6 to 8 feet in height, and many subcordate petioled leaves and clustered tuberous roots. There are several varieties, which are distinguished by the colour of the tubers—red, white, and yellow—and by the shape of the leaves, which are either narrow or broad. The tubers (rhizomes) are used as a vegetable principally during the winter, sometimes as a dish, but more generally for flavouring purposes. They are considered both wholesome and nutritious, and may be given to invalids when abstinence from other vegetable food is necessary. Before the potato became plentiful they were widely used in Europe, and they are still in great demand there for flavouring soups.

Jerusalem artichokes or topinambour are extensively cultivated in France for distilling purposes (as are potatoes and beet roots), yielding as much as 7 to 9 per cent of absolute alcohol. According to Payen, the average analysis of the tubers of Jerusalem artichokes is as follows:—

Water	..	..	..	76.04
Glucose and crystallizable sugar	..	..	14.70	
1. Inulin	..	..	1.86	
Cellulose	..	..	1.50	
Pectic acid and pectin	..	..	1.29	
Albumine and N. matters	..	..	3.12	
Fatty matters	..	..	0.20	
2. Mineral salts	..	..	1.29	
			—	23.96
				100.00

1. Inulin belongs to the amyloid group of the carbo-hydrates, and occurs in the roots of some plants, among which may be mentioned, in addition to the Jerusalem artichoke, the dahlia. Inulin is intermediate between gums and starch, and yields fermentescible sugar by prolonged boiling with dilute acid.

2. Of the mineral salts, more than one-fifth is potash.

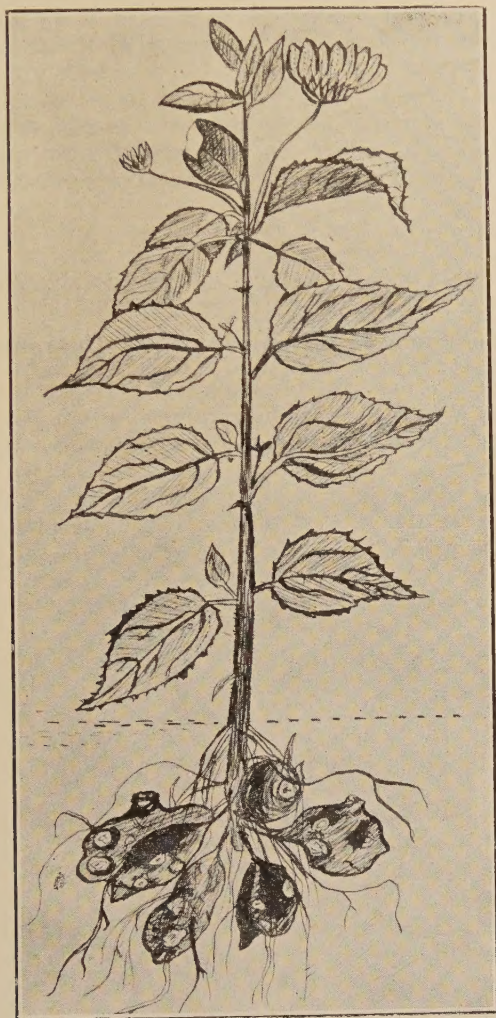
The composition of these tubers varies very much, according to the time they are dug up. The percentage of crystalline sugar is largest during the cold season, while, during the summer, starch—like inulin, gummy matters, and glucose—prevails. The tubers form very late, and should not be dug before the stems fade off, viz, in the autumn.

CULTIVATION.

The plant will succeed on a variety of soils, but generally gives the best results when grown on rich sandy loams. To insure the most successful results, trench over a piece of ground in the autumn and give a light dressing of nitrogenous and potassic manures, fork over in September, and then plant good-shaped tubers in rows about 3 feet

apart, allowing from 18 inches to 2 feet between the tubers in the lines. About 4 bushels will plant an acre. Artichokes may, with considerable advantage, be grown in rotation with maize.

When the plants are well above the soil they will keep in check any ordinary farm weeds, and very little cultivation will be required. Ten to twelve tons of tubers are considered an average crop. More



Jerusalem Artichoke—*Helianthus tuberosus*, L.

attention is now being paid to the cultivation of Jerusalem artichokes, as they are known to be good pig feed, and they are usually harvested by turning the animals into the field. The tubers will keep in the ground all the winter, and usually enough of them are left by the pigs to produce a new crop. An important element in their value for the feeding of swine is their availability during the entire winter and spring and the fact that their harvesting costs nothing. Though

artichokes are but little affected by frost, they do not stand storing in pits and silos, like beet root and potatoes.

This plant has of late years grown into favour as a marketable crop, and the demand seems to be increasing. Considering its very easy culture, it is fairly remunerative.

The following are the peculiar advantages of the Jerusalem artichoke over other fodder plants capable of being grown in this State:—

(1) It does not require to be planted every year; (2) it will yield more to the acre than potatoes; (3) it does not require harvesting; (4) it stands frost well; (5) it increases the yield of dairy cows to an extraordinary degree, and improves the quality of the milk; (6) it is one of the cheapest and healthiest pig foods raised, and is also an excellent food for cattle, sheep, and horses; and, finally, (7) it is highly important, because no insect, blight, or rust attacks it.

NEXT SEASON'S WHEAT CROP.

Commonwealth Government's Guarantee.

In announcing that the Commonwealth Government was willing to continue the Wheat Pool and guarantee 4s. 4d. per bushel for the 1919-20 harvest, the Acting Prime Minister (Mr. Watt) made the following statement:—

“Conflicting views have recently been placed before the Government in regard to the control of the wheat industry. The Federal Farmers' Organization has urged the continuance of the pool under conditions practically identical with those already arranged, the only variation of moment recommended being in regard to the constitution of the State Boards and the method of appointment by certain States of representatives upon the Central Board. On the other hand, representations have been made by traders that the purchase and sale of wheat by merchants and traders should be permitted at the end of the present season. The Government was also asked for a definite declaration of policy in respect to the general resumption of trade under normal conditions.

“No other trade presents such difficulties to an early restoration of pre-war conditions as the wheat business. The Government is not anxious to prolong indefinitely its responsibility, either of management or finance of wheat. It wishes to get out of the business as soon as it can do so safely. A general survey, however, shows that this cannot be done until the shipping and marketing positions become clearer. If we allow for loss through wastage, and for inferiority for sales already made to the British Government and other buyers, for anticipated further overseas sales and local consumption during the year, we have an exportable surplus of about 2,500,000 tons of f.a.q. wheat to dispose of.

“The Prime Minister has been authorized to offer 2,000,000 tons to the British Wheat Commission at 5s. per bushel. To this no definite reply has yet been received, but recent indications do not inspire great hope. An announcement by the British Food Controller made it appear as though 500,000 tons of wheat belonging to the British Wheat Commission in Australia would still be unshipped on 31st August, 1919.

According to later news, the Imperial Government is doubtful if the whole of its purchase will be lifted by the end of 1919. The position then will be, assuming that no sale is made to the Imperial Government, that by the end of the year we may expect to have 2,500,000 tons of f.a.q. wheat and considerable holdings of inferior wheat, with a new crop of, perhaps, 2,500,000 tons coming in. In these circumstances the resumption of normal trading would be impossible. Merchants could not make purchases on advances against the new harvest on a scale satisfactory to growers.

"As custodians of large quantities of wheat purchased by the Imperial Government, and having regard to our responsibilities to taxpayers and wheat growers, we should see that there is a systematic realization of our stocks. To reduce deterioration to a minimum, we should see that the oldest wheat is shipped first. We should not only eliminate competition to sell our wheat, but we should also avoid that competition for tonnage which would be so disastrous and result in such increased freight charges if indulged in by the Imperial Government, the Australian Wheat Board, and the merchants.

"This competition cannot be eliminated, and this systematic realization cannot be effected, unless the pooling scheme is continued for another year.

QUESTION OF GUARANTEES.

"The Federal Farmers' Organization has also asked for a guaranteed return from the 1919-20 harvest, and in this request has the support of the Victorian Chamber of Agriculture and of the Royal Agricultural Society of Victoria. In view of the present financial outlook, this question of guarantee is of vital concern to the taxpayer, whose interests are apt to be ignored. Demands are made that we should emulate the example of America, and give such a guarantee as will practically compel heavy contributions from revenue. It should not be overlooked that the purpose of the American guarantee was to insure an ample supply of foodstuffs to the Allies. Now that the shipping position has eased, America must face her losses, and it is not at all unlikely that her guarantee will result in a deficiency of hundreds of millions of pounds. The policy of the American Government will exert a powerful influence on overseas markets. If weather conditions prove favorable, she may have a yield of 1,200,000,000 bushels. If acute competition arises with other producing countries we may see a period of low prices. This may not be an unmixed evil for the Australian wheat grower, as it would mean a diminished area under crop the following year in America. But it would be a serious matter for the Australian taxpayer, whose credit had been pledged to afford encouragement to the wheat grower.

"The Government, however, is prepared, provided the States are willing to co-operate, to offer a guarantee for the coming year of 4s. 4d. per bushel, less freight from point of delivery to the port of export. To some growers, this guarantee may be disappointing, but to the enlightened majority it will prove acceptable. The Wheat Board's indebtedness is now over £20,000,000, and though the overdraft appears to have reached its apex its rapid diminution cannot be expected. If our wheat is unsold for twelve months, our interest bill will amount to

nearly 3d. per bushel, and, in addition, charges for upkeep and deterioration are inevitable. This is usually overlooked by those who suggest that the most profitable way to realize is to postpone the realization indefinitely.

"It is the intention of the Commonwealth Government to consult the States immediately to ascertain if they will fall in with the proposals for the continuance of the pooling system and of the guarantee. We have every reason to believe the States will accept these proposals, and so assure wheat growers, if not of a highly remunerative, yet of a profitable, return from their labours."

STALLION PARADES.

TIME TABLE, 1919.

(Subject to slight alteration if necessary.)

Date.	Place.	Time.	Officer Arrives.	Officer Departs.
Every Saturday :— June 21 to Dec. 27 ..	Agricultural Offices	10 a.m. to 12 noon		
July 21 to July 23 ..	Royal Show Grounds	10 a.m.		
WIMMERA No. 1.				
Monday, July 7 ..	Ararat ..	3 p.m. ..	1.27 p.m. ..	9.37 p.m.
Tuesday, July 8 ..	Goroke ..	3 p.m. ..	2 p.m. ..	6 p.m.
Wednesday, July 9 ..	Horsham ..	9 a.m. ..	9.25 p.m. (8th) ..	12.5 p.m. (10th)
Thursday, July 10 ..	Stawell ..	3 p.m. ..	2.41 p.m. ..	8.10 p.m.
WESTERN No. 1.				
Tuesday, July 15 ..	Coleraine ..	10 a.m. ..	7.35 p.m. (14th)	Driving
Tuesday, July 15 ..	Casterton ..	3 p.m. ..	Driving ..	8.30 a.m. (16th)
Wednesday, July 16 ..	Portland ..	1.5 p.m. ..	1.5 p.m. ..	2.55 p.m.
Thursday, July 17 ..	Hamilton ..	11 a.m. ..	6.8 p.m. (16th) ..	Driving
Thursday, July 17 ..	Balmoral ..	3 p.m. ..	Driving ..	Driving
CENTRAL No. 1.				
Wednesday, July 23	Inglewood ..	2 p.m. ..	1.30 p.m. ..	4.25 p.m.
Thursday, July 24 ..	Bendigo ..	11 a.m. ..	6 p.m. (23rd) ..	3.15 p.m.
MALLEE No. 1.				
Wednesday, July 30 ..	Birchip ..	11 a.m. ..	8.20 p.m. (29th)	1.37 p.m.
Wednesday, July 30 ..	Watchem ..	3 p.m. ..	2.4 p.m. ..	4 a.m. (31st)
Thursday, July 31 ..	Donald ..	11 a.m. ..	5.15 a.m. ..	12.25 p.m.
Thursday, July 31 ..	St. Arnaud ..	3 p.m. ..	1.50 p.m. ..	7.11 a.m. (1st Aug.)
MALLEE No. 2.				
Tuesday, July 29 ..	Mildura ..	3 p.m. ..	7.10 a.m. (29th)	8 a.m. (30th)
Wednesday, July 30 ..	Ouyen ..	3 p.m. ..	10.28 a.m. ..	9.45 p.m.